

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Previously presented) A computer implemented method of updating values in a complex structured type column in a relational database system, the method comprising:
 - representing modifications to a subset of a plurality of values in the complex structured type column using a data structure, wherein the plurality of values in the complex structured type column are embedded in a hierarchy having a plurality of levels within at least one row of the complex structured type column, wherein the subset of the plurality of values are embedded at arbitrary levels within the hierarchy;
 - aggregating changes to the subset of the plurality values at the arbitrary levels in the complex structured type column;
 - computing the data structure in response to a data modification statement on the database to determine the subset of the plurality values within the complex structured type column to update with the aggregated changes; and
 - applying the aggregated changes to the subset of the plurality of values in the complex structured type column.
2. (Previously presented) The method of claim 1, further comprising simultaneously updating the subset of the plurality of values with the aggregated changes, wherein the subset of the plurality of values comprises multiple scalar values at different levels within the hierarchy of the complex structured type column.
3. (Currently amended) The method of claim 1, further comprising simultaneously updating the subset of the plurality of values with the aggregated changes, wherein the subset of the plurality of values comprises a scalar value in a table ~~along~~ and a complex structured type value in the complex structured type column of said relational database system.
4. (Previously presented) The method of claim 1, further comprising embedding an INSERT/UPDATE/DELETE statement inside a SET clause of an UPDATE statement.

5. (Previously presented) The method of claim 4, further comprising embedding a plurality of nested SET clauses inside an outer-most UPDATE statement corresponding to each of the plurality of levels within the hierarchy of the complex structured type column.
6. (Previously presented) The method of claim 4, wherein computing the data structure comprises updating only indexes affected by specific scalar fields modified at various nesting levels by the SET clause in the UPDATE statement and updating only those rows of the index that correspond to the actual values that are modified by the UPDATE statement.
7. (Previously presented) The method of claim 1, further comprising providing Halloween Protection by computing the data structure and applying the aggregated changes separately.
8. (Previously presented) A relational database system responsive to database modification statements to store and update values in at least one complex structured type column, the relational database system comprising:
 - a parser that parses a database modification statement and produces a description of changes to a subset of a plurality of values in a complex structured type column proposed by the database modification statement, wherein the plurality of values in the complex structured type column are embedded in a hierarchy having a plurality of levels within at least one row of the complex structured type column, and wherein the subset of the plurality of values are embedded at arbitrary levels within the hierarchy;
 - a query optimizer that produces an execution algorithm to implement the database modification statement; and
 - a query execution engine that uses the execution algorithm to compute a data structure of the database modification statement to determine the subset of the plurality of values within the complex structured type column to be updated, wherein the data structure represents the subset of the plurality of values in the complex structured type column as an aggregation of changes to the subset of the plurality of values at the arbitrary levels of the hierarchy of the complex structured type column, and wherein the query execution engine

applies the changes to the subset of the plurality of values in the complex structured type column that are to be updated.

9. (Previously presented) The system of claim 8, wherein the query execution engine simultaneously updates the subset of the plurality of values with the aggregated changes, wherein the subset of the plurality of values comprises multiple scalar values at different levels within the hierarchy of the complex structured type column.

10. (Currently amended) The system of claim 8, wherein the query execution engine simultaneously updates the subset of the plurality of values with the aggregated changes, wherein the subset of the plurality of values comprises a scalar value in a table ~~along~~ and a complex structured type value in the complex structured type column of said relational database system.

11. (Previously presented) The system of claim 8, wherein the parser parses a SET clause of an UPDATE statement.

12. (Previously presented) The system of claim 11, wherein the parser parses the UPDATE statement in a plurality of nested SET clauses inside an outermost UPDATE statement corresponding to each of the plurality of levels within the hierarchy of the complex structured type column.

13. (Previously presented) The system of claim 11, wherein the query execution engine updates only indexes affected by specific scalar fields modified at various nesting levels by the SET clause in the UPDATE statement and updates only those rows of the index that correspond to the actual values that are modified by the UPDATE statement.

14. (Previously presented) The system of claim 8, wherein the query execution engine provides Halloween Protection by computing the data structure and applying the aggregated changes separately.

15. (Previously presented) A computer implemented method of updating values in a collection-valued column in a relational database system, the method comprising:

representing modifications to a subset of a plurality of values in the collection-valued column using a data structure, wherein the plurality of values in the collection-valued column are embedded in a hierarchy having a plurality of levels within at least one row of the collection-valued column, wherein the subset of the plurality of values are embedded at arbitrary levels within the hierarchy, and wherein the data structure aggregates changes to the subset of the plurality of values at the arbitrary levels inside the collection-valued column;

computing the data structure in response to a data modification statement on the database to determine the subset of the plurality of values within the collection-valued column to update with the aggregated changes; and

applying the aggregated changes to the subset of the plurality of values in the collection-valued column.

16. (Previously presented) The method of claim 15, further comprising simultaneously updating the subset of the plurality of values with the aggregated changes, wherein the subset of the plurality of values comprises multiple scalar values at different levels within the collection-valued column.

17. (Currently amended) The method of claim 15, further comprising simultaneously updating the subset of the plurality of values with the aggregated changes, wherein the subset of the plurality of values comprises a scalar value in a table ~~along~~ and a value in the collection-valued column of said relational database system.

18. (Previously presented) A relational database system responsive to database modification statements to store and update values in at least one collection-valued column, the relational database system comprising:

a parser that parses a database modification statement and produces a description of changes to a subset of a plurality of values in a collection-valued column proposed by the database modification statement, wherein the plurality of values in the collection-valued column are embedded in a hierarchy having a plurality of levels within at least one row of the

collection-valued column, and wherein the subset of the plurality of values are embedded at arbitrary levels within the hierarchy;

a query optimizer that produces an execution algorithm to implement the database modification statement; and

a query execution engine that uses the execution algorithm to compute a data structure of the database modification statement to determine the subset of the plurality of values within the collection-valued column to be updated, wherein the data structure represents the subset of the plurality of values in the collection-valued column as an aggregation of changes to the subset of the plurality of values at the arbitrary levels inside the collection-valued column, and wherein the query execution engine applies the changes to the subset of the plurality of values in the collection-valued column that are to be updated.

19. (Previously presented) The system of claim 18, wherein the parser parses a SET clause of an UPDATE statement.

20. (Previously presented) The system of claim 19, wherein the parser parses the UPDATE statement in a plurality of nested SET clauses inside an outermost UPDATE statement corresponding to each of the plurality of levels within the collection-valued column.

21. (Previously presented) The system of claim 18, wherein the query execution engine updates only indexes affected by specific scalar fields modified at various nesting levels by the SET clause in the UPDATE statement and updates only those rows of the index that correspond to the actual values that are modified by the UPDATE statement.

22. (Previously presented) The system of claim 18, wherein the query execution engine applies provides Halloween Protection by computing the data structure and applying the aggregated changes separately.